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Indian Standard

BASIC ENVIRONMENTAL TESTING PROCEDURES FOR ELECTRONIC AND ELECTRICAL ITEMS

PART XXVI SULPHUR DIOXIDE TEST FOR CONTACTS AND CONNECTIONS

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Indian Standard

BASIC ENVIRONMENTAL TESTING PROCEDURES FOR ELECTRONIC AND ELECTRICAL ITEMS

PART XXVI SULPHUR DIOXIDE TEST FOR CONTACTS AND CONNECTIONS

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BASIC ENVIRONMENTAL TESTING PROCEDURES FOR ELECTRONIC AND ELECTRICAL ITEMS

PART XXVI SULPHUR DIOXIDE TEST FOR CONTACTS AND CONNECTIONS

0. FOREWORD

0.1 This Indian Standard (Part XXVI) was adopted by the Indian Standards Institution on 5 June 1980, after the draft finalized by the Environmental Testing Procedures Sectional Committee had been approved by the Electronics and Telecommunication Division Council.

0.2 The differences in environmental testing procedures for component type items and equipment type items are fast disappearing in the context of technological developments. It is, therefore, felt necessary to have uniform testing procedures wherever possible. This series of standards on environmental testing procedures (IS : 9000) has been prepared with this objective. This is also in line with the principle adopted by IEC/TC 50 'Environmental Testing' in developing unified series of standards on environmental testing procedures by International Electrotechnical Commission.

0.2.1 It is proposed to withdraw the existing Indian Standards, namely, IS : 589-1961* and IS : 2106† series dealing with environmental tests for electronic components and equipment respectively, as soon as the tests mentioned therein are covered in the new series (IS : 9000).

0.3 This standard deals with the determination of the corrosive effects of sulphur dioxide on contacts and connections.

0.4 This standard (Part XXVI) shall be read in conjunction with IS : 9001 (Part VII) - 1980‡.

0.5 In preparing this standard, assistance is derived from IEC Pub 68-2-42 (1976) 'Basic environmental testing procedures, Part 2 : Tests, Test Kc : Sulphur dioxide test for contacts and connections' issued by the International Electrotechnical Commission.

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*Basic climatic and mechanical durability tests for components for electronic and electrical equipment (*revised*).

†Environmental tests for electronic and electrical equipment.

‡Guidance for environmental testing: Part VII Sulphur dioxide test for contacts and connections.

0.6 In reporting the result of a test made in accordance with this standard, if the final value, observed or calculated, is to be rounded off, it shall be done in accordance with IS : 2 - 1960*.

1. SCOPE

1.1 This standard (Part XXVI) covers the test intended to provide accelerated means to assess the corrosive effects of atmospheres polluted with sulphur combustion products on contacts and connections.

2. TERMINOLOGY

2.1 For the purpose of this standard, the definitions and explanation of terms given in IS : 9000 (Part I) - 1977† shall apply.

3. OBJECT

3.1 The object of this test is to determine the influence of atmospheres containing sulphur dioxide on the contact properties of precious metal or precious metal covered contacts excluding contacts consisting of silver and some of its alloys.

3.2 The major criteria of performance shall be the change in contact resistance caused by exposure to the sulphur dioxide containing atmosphere.

4. APPLICABILITY

4.1 This test is particularly suitable for giving information on a comparative basis. It may not predict the behaviour of contacts and connections in industrial atmospheres.

5. TEST CHAMBER

5.1 The test chamber and its auxiliary parts shall be made of materials that do not react with or absorb sulphur dioxide and which do not influence the corrosive effects of the test atmosphere. The atmosphere shall enter and leave the chamber through tubes with sufficiently large diameters such that the total flow through the chamber is at least 3 but not more than 5 changes of the atmosphere per hour. The exhaust from the chamber should not be allowed to enter the laboratory.

5.2 The detailed construction of the chamber including the method of producing the test atmosphere is optional provided that the following aspects are considered :

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*Rules for rounding off numerical values (*revised*).

†Basic environmental testing procedures for electronic and electrical items: Part I General.

a) The conditions in that part of the chamber occupied by the items are within the specified limits;

b) The items under test are protected from direct impingement of the incoming gas flow;

c) Arrangements are made to move the items through the test atmosphere at an average rate of 20 to 60 m/h (approximately 6 to 17 mm/s) or alternatively to gently stir the atmosphere, obtaining a similar relative velocity between atmosphere and item; and

d) Condensation does not occur on the inside walls of the test chamber.

5.3 Examples for suitable arrangements of test apparatus are given in Appendices A and B.

6. TEST ATMOSPHERE

6.1 The composition of the atmosphere within the test chamber shall satisfy the following conditions:

a) Sulphur dioxide : 25 ± 5 ppm (*v/v*);

NOTE — This shall be taken as the total oxides of sulphur expressed as SO_2. Small concentrations of sulphur oxides other than SO_2 (such as SO_3) are permitted to be present to a maximum concentration of 1 percent of the total sulphur oxides.

b) Carbon dioxide, *Max* : 4 500 ppm (*v/v*) permitted;

c) Temperature : 25 ± 2°C; and

d) Relative humidity 75 ± 5 percent.

6.2 The test atmosphere may be obtained by:

a) mixing directly the necessary constituents in such a way as to ensure a homogeneous mixture. An example for such a process is given in Appendix A; and

b) generating the sulphur dioxide by a burning process and adjusting the resulting gas mixture to the specified composition. An example for such a process is given in Appendix B.

7. INITIAL MEASUREMENTS

7.1 The items under test shall not be cleaned in any way, unless specified in the relevant specification.

7.2 The contact resistance shall be measured by the low open-circuit voltage method [for example, *see* **12.1** of IS : 3826 (Part I) - 1966*] in order to avoid damage to films formed on contact surfaces.

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*Specification for connectors for frequencies below 3 Mc/s: Part 1 General requirements and tests.

8. CONDITIONING

8.1 Prior to the commencement of the test suitable measurements shall be made to check the stability of the test atmosphere specified. Periodic checks shall be made during the test to ensure that these conditions are maintained.

8.2 The items shall be so placed that they do not come into contact with one another from the test atmosphere.

8.3 Adequate precautions shall be taken to ensure that the contacts are not disturbed during the exposure period.

8.4 Items shall be exposed with contacts open or closed or both, as prescribed in the relevant specification.

8.5 The loading or functioning of the items should be permitted when prescribed in the relevant specification.

8.6 The items shall be continuously exposed to the conditioning atmosphere for 4, 10 or 21 days, as required by the relevant specification.

9. RECOVERY

9.1 The items shall be removed from the chamber and stored under standard recovery conditions for 1 to 2 h before contact resistance measurements are made. Adequate precautions shall be taken to ensure that the contacts are not disturbed.

Note — If the necessary measurements cannot be made within the specified time, the period of storage under recovery conditions may be extended to a maximum of 24 h. Such an extension shall be mentioned.

10. FINAL MEASUREMENTS

10.1 The contact resistance shall be measured. The method used for measuring the contact resistance should be same as used for the initial measurement (*see* 7.2).

10.2 Items which are exposed with contacts in the mated condition shall have their contact resistance measured before they are unmated. Items exposed with contacts in the unmated condition shall be mated and the contact resistance shall then be measured.

Note — Repeated mating and unmating is not recommended.

10.3 Treatment of the contacts before final measurements, if required, and the details of measurements shall be as specified by the relevant specification.

10.4 The items shall be visually inspected, if required by the relevant specification.

11. INFORMATION TO BE GIVEN IN THE RELEVANT SPECIFICATION

11.1 When this test is included in the relevant specification, the following details shall be given, wherever applicable:

a) Measurements and checks to be made prior to the test (*see* **7**);

b) State of the contacts during the test, that is, mated (closed) or unmated (open) (*see* **8.4**);

c) Loading or functioning of the items, if applicable (*see* **8.5**);

d) Duration of the test (*see* **8.6**);

e) Measurements, checks and visual inspection to be made at the end of the test (*see* **10**);

f) Method of obtaining test atmosphere (*see* **6.2**); and

g) Any deviation in the test procedure.

APPENDIX A

[*Clauses* 5.3 *and* 6.2 (a)]

GENERATION OF THE CONDITIONING ATMOSPHERE BY DIRECT MIXING OF SULPHUR DIOXIDE WITH AIR

A-1. A typical apparatus suitable for producing the test atmosphere by directly mixing the necessary components is described in this appendix. Other apparatus and methods of mixing and control may be used provided they comply with all the requirements of this specification.

A-2. The test apparatus shown in Fig. 1 is composed of an air-conditioning unit, a gas supply with dosing pump, a test cabinet, a gas wash bottle for the removal of sulphur dioxide from the exhaust gases, an air flowmeter and a suction pump. The air-conditioning unit and test cabinet generally resemble commercially available climatic test cabinets. Commercially available pressure bottles of chemically pure gas, possibly diluted, can be used. The corrosive gas is mixed by way of a pressure reducing valve, a dosing pump and an injector with the flow of (temperature controlled and humidified) air from the air-conditioning unit. In the test cabinet, the gas is distributed uniformly by means of baffle plates. The test gas is removed from the test cabinet by the suction pump and passes through the gas wash bottle in which the corrosive gas component is removed. A freezing trap should be interposed between the gas wash bottle and the suction pump. The air flowmeter measures the air flow which is adjusted to the required value.

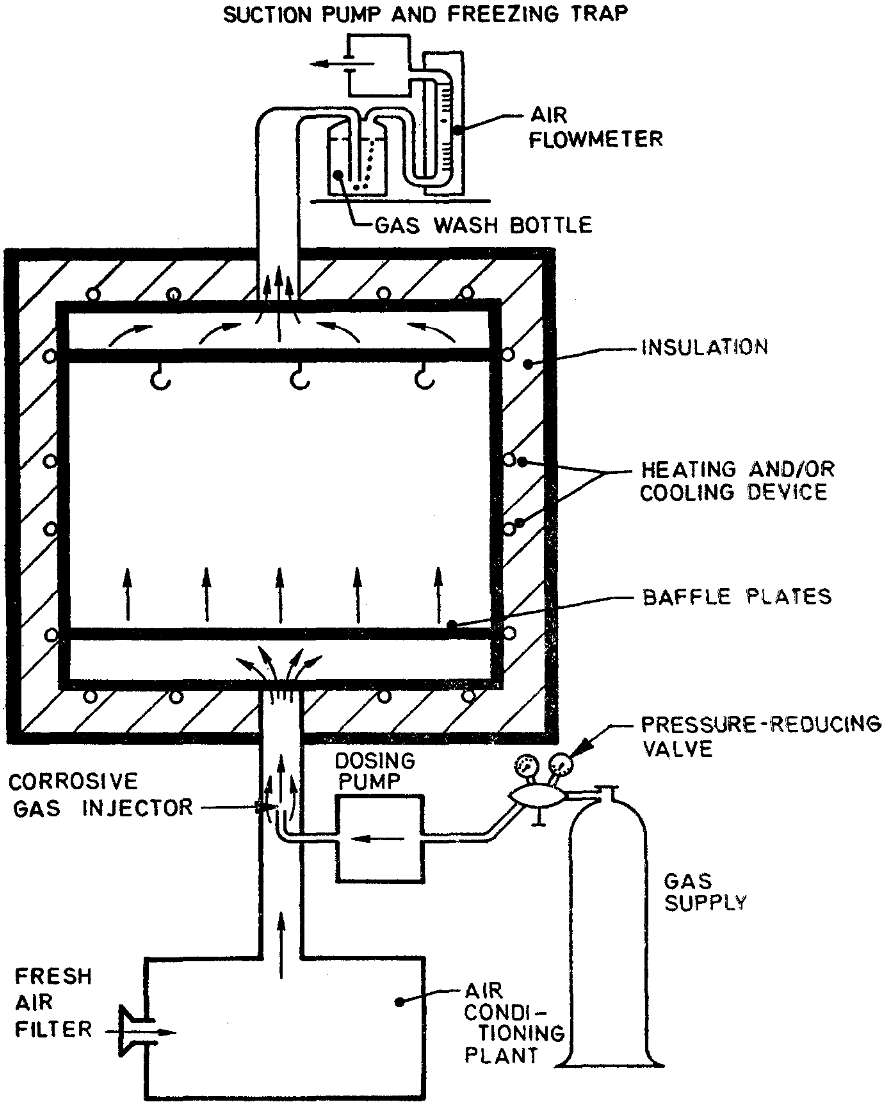

FIG. 1 SCHEMATIC DRAWING OF APPARATUS WITH GENERATION OF CONDITIONING ATMOSPHERE

APPENDIX B

[*Clauses* 5.3 *and* 6.2 (b)]

GENERATION OF THE CONDITIONING ATMOSPHERE BY COMBUSTION

B-1. This appendix describes a typical apparatus of approximately 200 litres capacity. Other apparatus and methods of producing the atmosphere may be used provided they comply with all the requirements of this standard (*see* Fig. 2 and 3).

B-2. The test atmosphere is generated by burning gas enriched with sulphur and diluting the products of combustion with air so as to give the required condition. This mixture is then continuously passed through the test chamber. Suitable gases are: natural gas, butane or propane. Carbon disulphide is used as a means of providing the enrichment of sulphur and the level of sulphur dioxide is controlled by adjustment of the temperature of the reservoir of carbon disulphide.

B-3. The relative humidity and temperature arising from combustion of the gas are unlikely to provide the specified conditions in the test chamber. It will therefore be necessary to provide means of adjusting the humidity and the temperature of the incoming air.

B-4. The design of the jet and the flow rates of the air and carrier gas shall ensure that complete combustion of the carrier gas is attained, as evidenced by a non-luminous flame. The flame size shall be 3 to 4 mm diameter and 8 to 12 mm high. The carbon dioxide levels given in Table 1 correspond to complete combustion and provide a guide to the rate of gas consumption.

B-5. Table 1 states the level of carbon dioxide and the flow rate, with appropriate control tolerances, for each of the specified gases. Monitoring the flow rate or the carbon dioxide concentration is required in order to check the stability of the test atmosphere.

B-6. The apparatus is built in two main parts, the exposure cabinet and the atmosphere generator.

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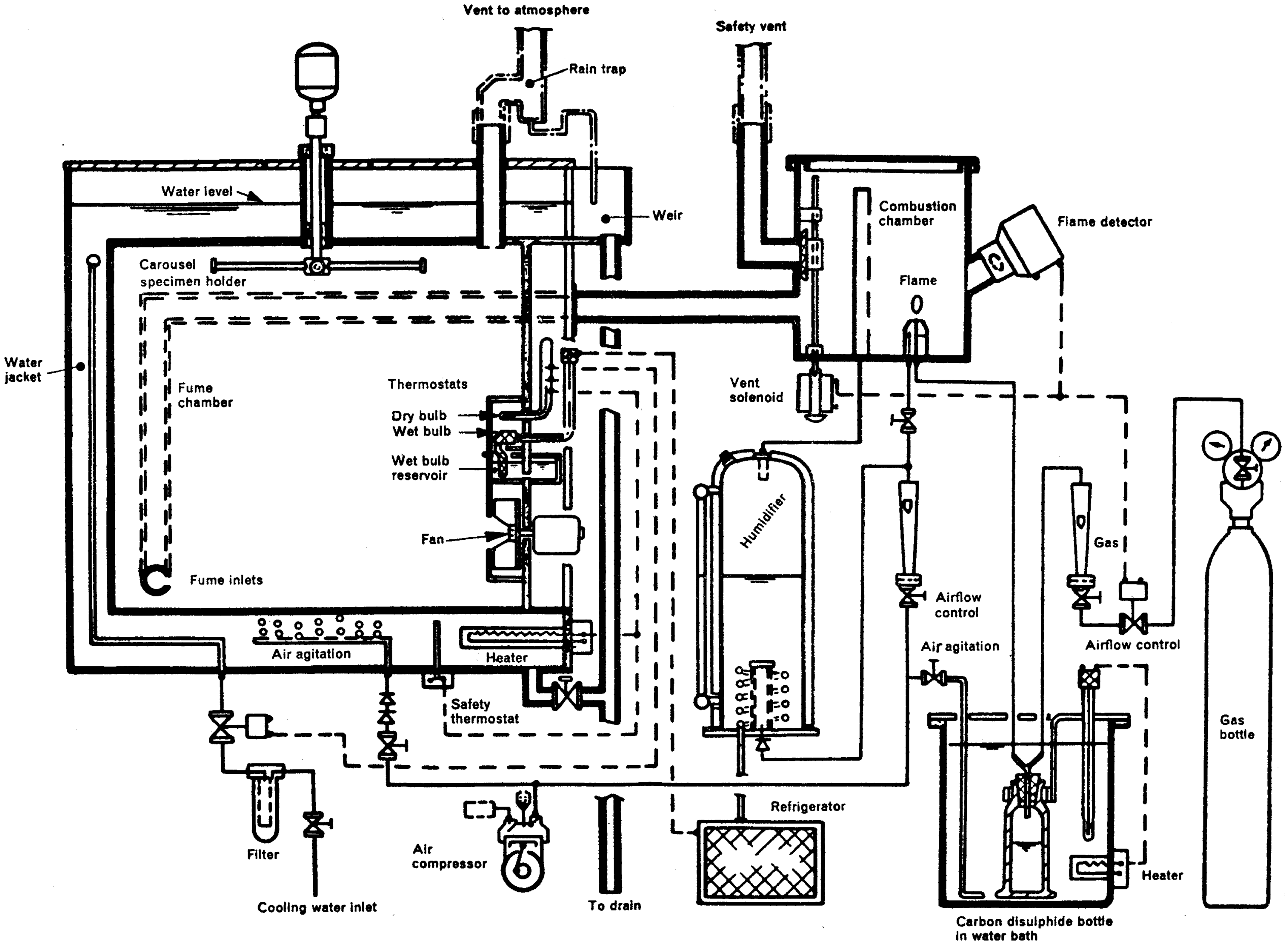

FIG. 2 POLLUTED ATMOSPHERE CABINET (COMBUSTION METHOD) — SCHEMATIC FLOW DIAGRAM

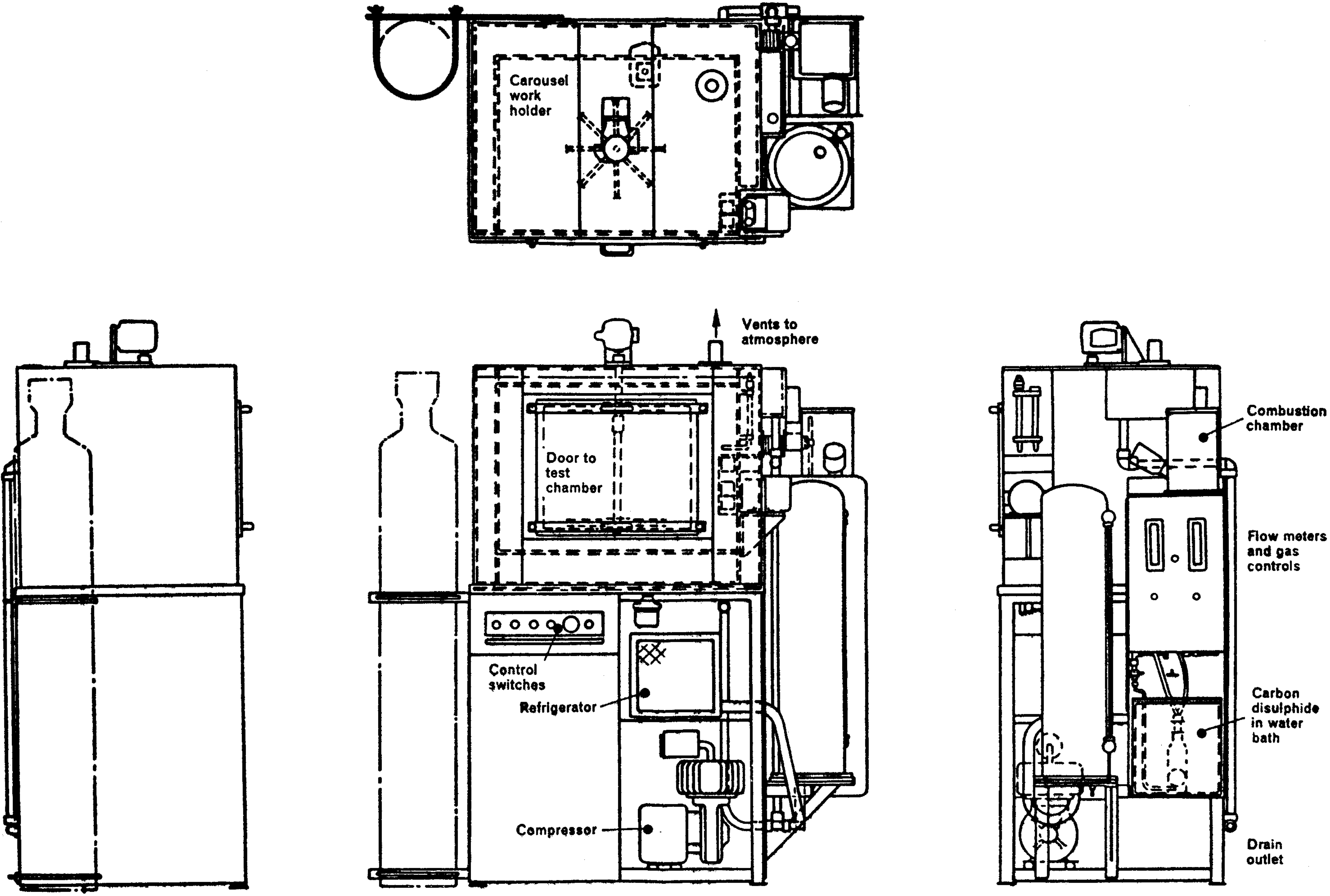

FIG. 3 POLLUTED ATMOSPHERE CABINET (COMBUSTION METHOD) — GENERAL ARRANGEMENT

TABLE 1 CARBON DIOXIDE LEVELS AND FLOW RATE

(*Clauses* B-4 *and* B-5)

GAS	FLOW, ml/min		CARBON DIOXIDE, ppm	
	Level	Tolerance	Concentration	Tolerance
Natural gas	35	±5	3 000	−500 +1 000
Butane	14	±2	3 500	−500 +1 000
Propane	10	±2	3 500	−500 +1 000

B-7. The cabinet, a 200-1 test chamber held at constant temperature by the thermostatically controlled water jacket, is made in acrylic resin sheet. Because the test temperature of 25°C is a difficult temperature to maintain, the water jacket which surrounds the cabinet is fitted with a heater, an injector tube for cooling water and agitation air. This arrangement results in good temperature control of the atmosphere, which first passes through a stainless-steel heat exchanger in the water jacket, before entering the cabinet itself. The atmosphere required for this test is generated by burning gas enriched with a sulphur-containing material, and mixing the products of combustion with clean humidified air. By control of the flow rate of the gas and the temperature of the sulphur enrichment solution, together with control of the air flow rate, humidity and temperature, a reproducible atmosphere is maintained throughout the test period. Only periodic atmosphere analyses are necessary to check any long-term drift of the atmosphere composition. It is not therefore essential to have expensive instruments to constantly monitor atmosphere composition.

B-8. An acrylic carousel item holder from which samples can be suspended is mounted in the top of the work chamber and driven at 1 rev/min by an external motor.

B-9. The temperature of the fume chamber is controlled by a double mercury-in-glass thermostat.

B-10. The humidity is controlled by a wet bulb thermostat with a refrigerator cooling a humidity tower, through which all air entering the chamber passes; the lower the temperature of the water, the lower the humidity. A heat exchanger in the water jacket stabilizes the gas temperature before it enters the chamber. The copper humidity tower is enclosed in an insulating jacket.

B-11. Built into the atmosphere generator are a number of safety devices which allow the cabinet to be operated with a minimum of skilled attention.

B-12. The gas flame is constantly monitored and a valve isolates the exposure chamber from the generator under all conditioning except when the gas flame is alight thereby preventing any possibility of build-up of flammable air-gas mixtures in the chamber. Other functional control equipment, such as air meters and solenoid valves, are mounted in a cabinet placed at the side of the chamber. The remaining control equipment and refrigerator unit are mounted in the base of the chamber.

B-13. SERVICES REQUIRED

B-13.1 The test cabinet requires services, namely, carrier gas, electricity, mains water, drainage and vent for waste gas. Bottled gas is preferred to the use of mains gas supplies in order to obviate possible fluctuations in gas pressure and composition which could cause changes in atmosphere composition.